PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Improvements in or relating to Antiseptic Film and Method and Apparatus for Producing the Same

We, PARACHEM CORPORATION, a corporation organized under the laws of the State of New Jersey, one of the United States of America, of 304 Oraton Street, North Newark, State of New Jersey, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a water soluble, sterile, non-toxic, antiseptic film adapted to be moistened and applied to a human or animal body on cuts, sores, infections and other external pathological conditions, for combining with and coagulating the blood and for arresting the spread of infection, and a method and machine for the continuous manufacture of such films.

It has been observed that devices such as Band-Aids, adhesives, and non-porous coating applied as liquids, as used in the protection and/or treatment of cuts, sores and infections, leave much to be desired. Non-porous protective films were found to be quite unsatisfactory due to the fact that they do not permit access of air to wounds; a necessary condition in the healing operation. Band-Aids were designed to eliminate this objection. They are, however, undesirably bulky and have to be replaced constantly, as they do not allow for satisfactory cleansing.

In the past treatment of open lesions such as are caused by burns, wounds and the like, the dressings which have been applied thereto, to supply medication or to serve as a protection against infections, have frequently interfered with rapid healing. When an ordinary dressing is applied to a moist lesion, the scab or granulation tissue formed at the surface of the lesion frequently becomes incorporated with the dressing so that the scab or new skin formed during the healing process may be pulled away when the dressing is removed, causing secondary hemorrhage.

A further disadvantage of past dressings has resulted from the fact that when a medicament has been required in the treatment of an open lesion, it has been necessary to apply a fresh dressing to the lesion at frequent intervals, usually as often as at least once each day to replenish the medicament, resulting in disturbance and irritation of the lesion. Attempts have been made to overcome these disadvantages, which are inherent in ordinary surgical dressings, through the use of non-fibrous films. However, such films have been so stiff and harsh that they could not conform evenly to the surface of the lesion and they have had an irritating effect thereon which was not conducive to speedy healing.

We have discovered that it is possible to prepare a soft, pliant film which can be applied evenly to the surface of a moist lesion, which will not irritate the lesion, but will become incorporated with a scab or granulation tissue formed therein, by modifying a quantity of water soluble cellulose compound with an appropriate plasticizing agent and a proportion of water. The film so formed also possesses sufficient cohesion to provide a resilient support when used as a dressing and to permit of its being molded to conform with the contour of a part of the body, such as a hand.

It is a particular feature of the invention that we may incorporate in the film a chemotherapeutic agent which is slowly released therefrom in an effective quantity in a form in which it is miscible with the body fluids, thereby obviating the necessity for frequent changes of the dressing of a wound which requires medication. It is a further and im-

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portant feature of the invention that the soft, pliant, adherent film can be reinforced by embedding a textile material in the outer surface thereof.

There is known a film-forming solution which can be sprayed on a burn or wound to form an eschar. In the treatment of burns, it is generally considered that an early formation of a sterile or uninfected eschar is of primary importance. The proposed medicament was previously applied to a burn in a triethanolamine solution and it took three days to form an eschar. In accordance with this patent, methyl cellulose has been added and the time of eschar formation cut down to about a day.

The present invention is based on the fact that a precast eschar can be applied immediately and handled like a bandage. Said eschar is transparent, antiseptic, and may be partially dissolved by exuding sores to form adhesive contact and release the medication. An eschar so formed has porosity similar to a natural eschar and healing progresses rapidly. On the other hand, the film can be removed by treatment with water without disturbing the wound in any way, the materials employed acting as a natural coagulant for blood.

It is known to form aqueous solutions of compounds of sulfadiazene and salts of salicylic acid, with particular relation to compounds of this type that yield stable aqueous solutions adapted to be administered by injection. Extensive clinical tests have shown that the product sulfadiazene and a salicylate of an alkali metal is a most effective cure for streptococcus and pneumococcus infections, as well as being a wonderful healing agent for wounds and secondary infections of all kinds, doing about everything that penicillin does without the frequent side effects. We, therefore, propose to incorporate this material in films embodying the present invention.

There is also known that surgical dressings having a hemostatic quality may be prepared using a free acid carboxy methyl cellulose or carboxy ethyl cellulose. The surface of gauze dressing is impregnated with a hemostatic agent, in this case carboxy methyl or ethyl cellulose or a salt thereof. They have demonstrated by the treatment of rats, that bleeding time can be reduced from five minutes to one minute, fifteen seconds, due to the hemostatic quality of the cellulose compound, without the necessity of applying pressure.

It is known to use, in such surgical dressings, a poly-ol compound to act as a stripping agent and allow for convenient removal of the bandage. However, in all cases the cellulose compound is treated to obtain free acid cellulose ether, as by heating, to form such as the refractory free acid carboxy methyl cellulose. Implantation tests show that the free acid cellulose ether was completely absorbable by the body.

The important differences in the invention, as compared with such surgical dressings, is that we have created an unsupported medical film or bandage which is soluble in blood plasma and weeping secretions, combines with and coagulates the blood by its inherent hemostatic qualities derived from the film-containing cellulose glycolic acid ether, and has the physical property of containing the blood flow, to promote coagulation, with a film or bandage which need not be removed from the wound and which film may carry medicaments, antiseptics, bacteriastatic agents and the like, suitable for treating an infection. The present film contains no tackifier as the inherent solubility of the film in water allows for adhesion to the skin.

It is, therefore, an object of the present invention to provide a material which (1) coagulates the blood, (2) allows for the transmission of air, (3) gives adequate protection against foreign matter. (4) It may have incorporated therein medicinal matter such as germicides, antiseptics and antibiotics, and (5) can be removed from the skin by redissolving in water.

Another object of the invention is to provide a self-supporting film of a substantially uniform thickness comprising a water soluble cellulose compound, a plasticizer and, in the alternative, a skin treating agent.

A further object of the invention is to provide a self-supporting film as above set forth in which the cellulose compound is sodium carboxy methyl cellulose or hydroxy ethyl cellulose, in which the plasticizer is glycerol, and in which the treating agent, if used, is iodine, sulfanilamide and/or sulfathiozole.

A still further object of the invention is to produce material which may be used to apply a precast eschar to the skin in the form of a water-soluble transparent porous film which can be handled like a bandage, is antiseptic, and is partially dissolved by exuding sores to form adhesive contact and release medication.

An additional object of the invention is to provide a self-supporting soluble film which may be applied as a healing covering over even an exuding sore on the skin, make an artificial eschar thereover, retard the flow of plasma thereunder, and avoid the formation of blisters.

According to one aspect of the present invention, there is provided a film-like bandage adapted to hold medicaments and release them to the skin when used thereon, comprising a water soluble, flexible, self-supporting, thin, air-transmitting, porous, hemostatic sheet, soluble in plasma and other liquids at body temperature after application to the

skin, of substantially uniform thickness, of a cellulose ether selected from carboxy alkyl celluloses and hydroxy alkyl celluloses and alkali metal salts thereof, and a plasticizer therefor, the sheet having been produced from an aqueous solution containing the cellulose ether and plasticizer.

According to another aspect of the invention, there is provided a method of making the precast bandage, comprising forming an aqueous solution of the cellulose ether and plasticizer, applying the solution onto the surface of a moving belt having a poly (tetrafluoroethylene) film casting surface, heating the solution on the belt to form a dried sheet or film therefrom and thereafter removing the sheet or film from the belt.

According to a further aspect of the invention, there is provided an apparatus for carrying out the method according to the present invention, comprising means for forming a solution of the cellulose ether and plasticizer, a hopper for feeding the solution, a belt movable beneath said hopper and having a poly (tetrafluoroethylene) film casting surface for receiving a film of solution fed from said hopper, a heating zone through which the belt can pass and means for removing a dried sheet or film from the belt.

If desired, the apparatus can include means for aerating the solution, advantageously comprising a reservoir for containing said solution, a positive displacement pump connected to the reservoir for drawing solution therefrom and returning part of it thereto, coils for cooling the part of the solution returned to the reservoir, a high speed mixer to which is directed the part of the solution not returned to the reservoir, and means for directing the output from the mixer partly back to the reservoir, with the remainder available through a demand valve for flowing to said hopper.

For a better understanding of the invention and to show how the same may be readily carried into effect, reference will now be made, by way of example, to the accompanying drawings, in which:—

Figure 1 is a transverse section, greatly enlarged, of a reinforced film embodying the invention.

Figure 2 is an enlarged plan of a piece of reinforced film embodying the invention.

Figure 3 is a perspective view of a non-adherent film embodying the invention and molded to fit a human hand.

Figure 4 is an elevational view of a machine for manufacturing film embodying the invention.

Figure 5 is a diagrammatic view of an alternative machine which may be used with that of Figure 4 for practising the invention.

One of the first requirements of the invention is the development of a film that is water-soluble, has very good tensile strength when dry, and is flexible enough to be handled readily without damage. Such a film also has to be a pure product that is free from toxicity. A primary requirement is a material that will afford the same protection as a clot of blood, with equivalent air transmission. In other words, we desire to synthetically produce a protective material that is the equivalent of nature's method of protecting sores. The choice of products approximating these qualifications include water-soluble cellulose derivatives such as the following, which are cited as examples:

Sodium carboxy methyl cellulose
Hydroxy ethyl cellulose

Of the above, we prefer sodium carboxy methyl cellulose. This product may be obtained from suppliers, an example being Hercules Powder Co., in such a pure condition that it is edible, being used as a thickener in products such as ice cream. A preferred grade 7L is readily soluble in water and, when plasticized by a material such as glycerol, can be formed into a film of great elasticity and excellent tensile strength. Other plasticizers are sorbitol, "Corpolin" (registered Trade Mark to Heyden Chemical Corp.), and ethylene glycol. After forming, such a film is readily redissolved in water and can be cast in various thicknesses from a water solution, with or without aeration, as on a heated drum or belt, the mechanical development of which will be described later.

Tests have been conducted on simple cuts and it was found that the film would not only coagulate the blood, but would also combine with it, forming an artificial eschar which permitted healing thereunder. Repeated washings merely diminished the thickness of the film around the sore and gradually removed it as the healing progressed.

A further embodiment of the invention is the inclusion in the film of antiseptic, medicinal, germicidal and/or antibiotic materials in order to minimize infection or to cure such after it has occurred. A primary embodiment of this idea is the incorporation of iodine into the film. At the present time there is no entirely satisfactory method of dispensing iodine. It is sold to-day in low percentage alcoholic solutions, but the initial percentage of a fresh bottle is not maintained because repeated usage results in evaporation of the alcohol itself, concentrating the content of the iodine to a point where it may become dangerous. We have been able to incorporate iodine into the present film so that it has a definite content whereby the film can be dispensed in small book form or as loose leaves in a container.

A still further embodiment of the invention is the incorporation of sulfa drugs in the film. Due to their antiseptic properties in surface infections, an easy method of using

them by the general public would undoubtedly arrest the danger of serious infection in a great many cases. Development work shows that while the sulfa drugs are not soluble or compatible with the film, they can be dispersed therethrough and are maintained in the dried film in a uniform surface content. There is, therefore, no limit to the concentration of the drug in the film. The same procedure can be followed in the use of other healing agents that are now known to the medical profession, the only limitation in this respect being the effect of heat in the process of film development.

Although a film embodying the invention may be used in unsupported form with or without various antiseptic and/or drug materials, yet, if it is desired to make it stronger, it may be reinforced as by coating cotton or fabric with the film-forming solution, with or without the various drugs, and drying to produce a smooth film coating. In places where adhesive tape is now used and has serious objections due to the difficulty of its removal, no such problem would be encountered with a cellulose-coated fabric embodying the invention. It would merely suffice to soak this tape or bandage in water to readily remove it.

Generally speaking, a film of the type embodying the invention would be of great help to the medical profession in performing operations. Film of this kind can be used to arrest the flow of blood and no removal is necessary as it would gradually be absorbed and disappear in the system. Such a film may be used to close cuts with avoidance of the use of stitches. It is considered that it may be used in such infections as athlete's foot, fungus growths, poison ivy, etc. Such infections are spread unintentionally by individuals. A protective film over the sore will localize the infection, at the same time providing the correct form of medication. Being transparent, observation of the sore is permitted without removal.

The film is normally prepared from a mixture of approximately 70 to 85 parts, by weight of a carboxy or hydroxy alkyl cellulose; e.g.—hydroxy ethyl cellulose or a soluble alkali metal salt of carboxy methyl cellulose, together with 15 to 30 parts, by weight, of a suitable plasticizer such as glycerol.

While either hydroxy ethyl cellulose or a water-soluble alkali metal salt of carboxy methyl cellulose (e.g., the alkaline earth metal salts or the ammonium, sodium or potassium salt thereof) is operative as the base material in the practice of the present invention, sodium carboxy methyl cellulose is preferred, and particularly that having a substitution of at least 0.3 to 1.2 and usually from 0.65 to 0.95; substitution referring to the average number of sodium carboxy methyl groups per anhydroglucose unit of the cellulose structure, each unit having three reactive hydroxy groups (i.e., if complete substitution of sodium were obtained the substitution number would be 3.0).

These base substances in addition to being rapidly water-soluble, should possess a maximum concentration and minimum viscosity; hence the viscosity thereof should not exceed 1000 centipoises (cps) and most desirably should be in the range of from 10 cps to 750 cps. The term "viscosity" as employed herein is expressed as the logarithm of the viscosity in centipoises at 25° C. of a 2 percent aqueous solution of the carboxy or hydroxy alkyl cellulose employed.

The plasticizer selected for use herein while not narrowly critical is normally a liquid saturated acyclic alcohol, substituted or unsubstituted, containing normally not in excess of six hydroxy groups. Illustrative of these are glycerol, diglycerol, glycerol α monomethyl ether, glycerol monochlorohydrin, 1,2,6-hexanetriol, ethylene glycol, propylene glycol, 2,3-butylene glycol, 2-nitro-2-methyl-1,3-propanediol and ethanolamines such as 2,2'-dihydroxydiethylamine, 2-hydroxy ethylamine and the like.

The porous or cellular sheets or films of the invention may be generally free from air or purposely aerated, as by agitation to be described, so as to have an air content of preferably about 30% to 40% by volume in the form of very small bubbles.

The following Examples illustrate the invention:

Example 1

As a typical solution for the preparation of films embodying the invention, we may take 8.73 grams of sodium carboxy methyl cellulose and together with .87 gram of glycerol, dissolve in 90 grams of water. If desired, it may be mixed with some antiseptic, such as .2 gram iodine and .2 gram potassium iodide. The solution is dark green in color. When made into a film, the formula thereof as finished, disregarding the water content, is 87.27% sodium carboxy methyl cellulose, 8.73% glycerol, 2% iodine and 2% potassium iodide. Such a film is clear and one square inch thereof dissolves in water in 1 minute, 15 seconds. It has good flexibility, moderate elasticity, and although sheets of the film show a very slight tendency to stick together under compression, they can be separated easily. Although there was only a very small amount of free iodine in the film, there was a similarly large amount combined therewith. This combined iodine is easily displaced and free iodine obtained in quantity with a reagent such as chlorine gas.

Example 2

As another example of film embodying the invention, we may take 8.2 grams of sodium carboxy methyl cellulose and together with

.8 gram of glycerol dissolve in 90 grams of water. If desired, it may be mixed with some antiseptic such as 1 gram of sulfanilamide. The formula of the film formed from this solution, disregarding the water content, is 81.82% sodium carboxy methyl cellulose, 8.18% glycerol and 10% sulfanilamide. Such a film is clear, readily soluble, has good flexibility, although low elasticity, and its sheets do not stick together under compression. Such films may be separated from the skin in one piece when dry. The film so manufactured was filled with white blotches.

EXAMPLE 3

As a further solution for the preparation of films embodying the invention, we may take 9.6 grams of sodium carboxy. methyl cellulose, 2 grams of glycerol and dissolve in 85 grams of water. If desired, we may mix with 1.3 grams of sulfathiozole. Although this has a smaller percentage of water than the previously mentioned examples, in an effort to increase the thickness, it was found that the reduction of water did not materially increase such thickness. The film removed easily from the machine, such as will be disclosed and, in finished form, contained about 10% of the medication.

EXAMPLE 4

Composition of Solution

Sulfanilamide	0.1 gm.
Sodium carboxy methyl cellulose	9.0 gms.
Glycerol	0.9 gm.
Water	90.0 gms.

Composition of film after being cast on machine:

Sulfanilamide	1.0%
Sodium carboxy methyl cellulose	90.0%
Glycerol	9.0%

Solubility: A one inch square of the film dissolves in water at 28° C. in 1 minute, 10 seconds.

EXAMPLE 5

Example of Aerated Film

Sulfanilamide	0.1 gm.
Sodium carboxy methyl cellulose	9.0 gms.
Sodium lauryl sulphate	4.0 gms.
Glycerol	0.9 gm.
Water	90.0 gms.

This solution after mixing for complete solution was passed through homogenizing mixer to reduce viscosity and aerate solution, as will be described. It was then case on "TEFLON" belt, as will be described.

EXAMPLE 6

Formula of Solution

Sodium carboxy methyl cellulose	9.6 gms.
Glycerol	1.7 gms.
Sulfathiozole	0.6 gm.
Water	86.0 mls.

The sulfathiozole has good compatibility in the above solution and concentrations were increased from 0.6 gm. to 2.9 gms.

EXAMPLE 7

Water soluble Sulfadiazine (alkali salicylate, as disclosed in Patent No. 2,510,993)	0.1 gm.
Sodium carboxy methyl cellulose	9.0 gms.
Glycerol	0.9 gm.
Water	90.0 gms.

The above solution was cast into film by passing through "TEFLON" belt equipment to produce a dense film, as will be described. To produce aerated film the solution was passed through machine before application to the belt, as will be described.

Referring to the drawing in detail, there is shown in Figures 1 and 2 a reinforced film 5 which may be prepared by depositing on a strip of gauze 6. Such a strip may be carried by the moving belt of the machine of Figure 4 and, during the corresponding operation, a solution embodying the invention may be deposited thereon. The gauze, after drying and stripping from the belt, will be embedded in the lower surface of the film. It may then be removed and wound up or cut into strips, as desired. When such a reinforced film is used as a surgical dressing, the face in which the gauze is embedded forms the outer surface of the dressing. The gauze is thus insulated from the wound by the soluble film which prevents the gauze from injuriously sticking thereto.

Such a film-forming mixture embodying the invention may be applied to the outer smooth surface of a form, shaped to conform to one of the parts of the human body, such as a hand. The coated form may then be placed in an oven and heated to a suitable temperature until dry. At the end of the drying period, the form is covered with a film which can be stripped therefrom and resembles a glove, as illustrated in Figure 3. A film which has been formed in this manner may be used as a glove to cover the hand, for example, and forms a very effective surgical dressing for a part of the body which cannot be easily covered by conventional surgical dressings.

The machine of Figure 4 for manufacturing film embodying the invention comprises a hopper 7 from which a film approximately .008" thick may be dragged out by the moving belt 8. The belt then passes through a heating zone provided beneath heaters 9 and excess water is evaporated therefrom, leaving a dry film on the belt. Such a film 10 is then removed as the belt goes around a drum 11, which may be belt-driven from a suitable electric motor 12. The film may be wound on a roller 13, suitably supported as illustrated. Release of the dry film from

the belt is accomplished due to the non-adhering surface provided on the belt employing such material as "TEFLON" (registered Trade Mark) to be more fully described. Such a surface is necessary in order that the dry film may be self-releasing.

A film composed of poly (tetrafluoroethylene) or "TEFLON" which resin is described by W. M. Renfrew and E. E. Lewis, Industrial and Engineering Chemistry, Vol. 38, page 870 (1946); R. C. Doban et al, Society of Plastic Engineers Journal, Vol. 11, page 9 (November 1955) and P. E. Thomas et al, Society of Plastic Engineers Journal, Vol. 12, page 6 (June 1956) is particularly desirable as the drying surface for the compositions of the present invention; and indeed represents a significant improvement over other procedures employing, for example, a metal surface or the like.

A glass-coated fabric thereof (e.g. "ARMALON", registered Trade Mark, a product of E. I. DuPont de Nemours & Co., Inc., Fabrics Division, Fairfield, Connecticut); a metal coated platen or belt, or alternatively a heat-bonded film (e.g., by the procedure described by R. J. Wayne and W. M. Bruner, Society of Plastic Engineers Journal, Vol. 11, page 10, (December 1955) attached to an under surface of a material which is heat resistant at the highest processing temperature for the protective film (e.g. 300° F) and chemically inert, can by way of illustration, be employed. Where coated on glass or metal surface, the thickness of the polymer is usually in the range of 3 to 10 mils. For heat-bonding to another surface composed of another material or poly (tetrafluoroethylene) or freely supported on an under surface, e.g., metal, canvas, thicknesses of from 20 mils or less to 120 mils are normally employed. Films in excess of this thickness and preferably in excess of 200 mils are self-supporting.

Poly (tetrafluoroethylene), particularly that having a density of .035 and in a range of .030 to .040 and a softening point of about 620° F., is preferred due to the non-adhering surface it presents to the dried detergent film permitting ease of removal of the film therefrom. This property is so marked that non-ionic surface active agents included in the film composition for release thereof from the drying surface can be, and preferably are, omitted.

The machine of Figure 5 for aerating film-forming solutions embodying the invention comprises a reservoir 14 from which a solution of high viscosity is pumped through positive displacement pump 15, a portion being returned to the reservoir through cooling coils 16 and a portion going to the high speed mixer 17. Said mixer is desirably operated at a speed of about 3,450 R.P.M. in a counter-clockwise direction, when the connections are made as viewed in the drawing, so that the solution flows onto the approaching edges of the mixer rotor blades. From the mixer, the solution of lower viscosity is directed through the discharge pipe 18, and all of it is returned to the reservoir, through pipe 19 controlled by needle valve 20, except that which is shunted to the applicator machine of Figure 4 through demand valve 21.

The purpose of the aforedescribed apparatus is to prepare the sodium carboxy methyl cellulose in combination with an emulsifying agent, such as sodium lauryl sulphate, and a suitable medicinal or antibiotic material, a plasticizer and water for continuous coating, drying and subsequent removal from belt of the "TEFLON" or the like which is part of the machine of Figure 4. The apparatus achieves three main objectives, as follows:

(1) It reduces the viscosity of the solution from what may be approximately 100,000 centipoises to about 2,000 centipoises. This reduction facilitates metering the solution with uniform thickness to the "TEFLON" belt.

(2) It reduces the density of the solution, as in emulsification, by introduction and dispersion of air in the form of every minute or microscopic droplets, thereby permitting removal of the solution, after drying, from the belt in continuous form.

(3) As a result of homogenous low density film, the solubility thereof in water after finishing is greatly enhanced. This is of the utmost importance insofar as usefulness of the finished product is concerned. The physical changes in the solution and in the film produced therefrom after finishing, brought about by high speed close tolerance agitation, are very important for the successful production of film which is rapidly soluble in water.

From the foregoing disclosure it will be seen that we have provided a self-sustaining film which may be produced from aqueous solution by introducing it onto the surface of a moving belt of poly (tetrafluoroethylene) or "TEFLON" and heating said solution for a period sufficient to form a dried film thereon and then removing said film from said belt.

Drying of the liquid film is continued until its water content is about 5 to 15 percent of the weight of the film. A substantially smaller proportion of water than 5 percent gives rise to films which are too brittle for the purpose. A substantially larger proportion than 15 percent of water furnishes a film which is too soft and not readily handled.

Dried films whose thicknesses vary from about 0.001 to 0.006 inch are suitable for use as medical or sterile protective films. If the thickness is substantially less than 0.001 inch, the film is brittle and also lacking in

strength and therefore breaks easily. The desirable thickness above the lower limit will depend on the use for which desired. If the film is too thick, its rate of solution in water becomes undesirably slow. Preferred thicknesses are in the range of .003 to .004 inch.

From the foregoing disclosure it will be seen that we not only propose to produce a film which is either aerated or not, medicated or not, but one which may be reinforced. All of these films are preferably composed of sodium carboxy methyl cellulose, glycerol, and may have a medicament and/or emulsifying agent. When a water solution of the composition is aerated, as by passing through the equipment of Figure 5, the film so produced has almost instant solubility in water and body fluids. Such a film consequently has remarkable hemostatic and medicament-release qualities. Its value for stubborn bleeding, especially in internal operations, is readily apparent and the application thereof can be followed by subsequent bandages of other types for protection and containment.

WHAT WE CLAIM IS:—

1. A film-like bandage adapted to hold medicaments and release them to the skin when used thereon, comprising a water soluble, flexible, self-supporting, thin, air-transmitting, porous, hemostatic sheet, soluble in plasma and other liquids at body temperature after application to the skin, of substantially uniform thickness, of a cellulose ether selected from carboxy alkyl celluloses and hydroxy alkyl celluloses and alkali metal salts thereof, and a plasticizer therefor, the sheet having been produced from an aqueous solution containing the cellulose ether and plasticizer.

2. A bandage according to Claim 1, wherein the cellulose ether is carboxy methyl cellulose or an alkali metal salt thereof, or hydroxy ethyl cellulose.

3. A bandage according to Claim 2, wherein the cellulose ether is sodium carboxy methyl cellulose.

4. A bandage according to any preceding claim, wherein the plasticizer is glycerol.

5. A bandage according to any preceding claim, wherein the bandage also contains one or more medicaments, germicides, antiseptics, or antibiotics.

6. A bandage according to Claim 5, wherein the bandage contains a sulfa drug.

7. A bandage according to Claim 5 or 6, wherein the bandage contains iodine.

8. A bandage according to Claim 5, 6 or 7, wherein the bandage contains sulfanilamide.

9. A bandage according to Claim 5, 6, 7 or 8, wherein the bandage contains sulfathiazole.

10. A bandage according to any one of Claims 5 to 9, wherein the bandage contains sulfadiazine and the salicylate of an alkali metal.

11. A bandage according to any preceding claim, supported as a coating on a gauze.

12. A bandage according to any of the preceding claims in which the thin sheet is of reduced density by having air dispersed therethrough as minute pockets and the water solution from which it is formed contains an emulsifying agent.

13. A bandage according to claim 12, in which the emulsifying agent is sodium lauryl sulfate.

14. A bandage according to claim 12 or 13 in which the water solution from which it is formed contains a medicament.

15. A film-like bandage adapted to hold medicaments and release them when applied to the skin, substantially as described in any one of the foregoing Examples.

16. A method of making a film-like bandage as claimed in any preceding claim, comprising forming an aqueous solution of the cellulose ether and plasticizer, applying the solution on to the surface of a moving belt having a poly (tetrafluoroethylene) film casting surface, heating the solution on the belt to form a dried sheet or film therefrom and thereafter removing the sheet or film from the belt.

17. A method according to claim 16, wherein the viscosity of the solution is reduced by subjecting the same to a high rate of shear.

18. A method according to Claim 16 or 17, wherein an aerated condition in the solution is created and maintained by subjecting the solution to a high speed mixing.

19. A method according to Claim 16, 17 or 18, wherein an emulsifying agent is also added to the aqueous solution.

20. A method according to claim 19, wherein the emulsifying agent is sodium lauryl sulfate.

21. A method of making a film-like bandage as claimed in any one of claims 1 to 15, substantially as described in any one of the foregoing Examples.

22. An apparatus for carrying out the method claimed in Claim 16, comprising means for forming a solution of the cellulose ether and plasticizer, a hopper for feeding the solution, a belt movable beneath said hopper and having a poly (tetrafluoroethylene) film casting surface for receiving a film of solution fed from said hopper, a heating zone through which the belt can pass and means for removing a dried sheet or film from the belt.

23. An apparatus according to claim 22, and including means for aerating the solution comprising a reservoir for containing said solution, a positive displacement pump connected to the reservoir for drawing solution therefrom and returning part of it thereto,

coils for cooling the part of the solution returned to the reservoir, a high speed mixer to which is directed the part of the solution not returned to the reservoir, and means for directing the output from the mixer partly back to the reservoir, with the remainder available through a demand valve for flowing to said hopper.

24. An apparatus for producing a film-like bandage as claimed in any one of claims 1 to 15, substantially as hereinbefore described, with reference to, and as shown in, Figures 4 and 5 of the accompanying drawing.

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942305 COMPLETE SPECIFICATION
1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

FIG. 1

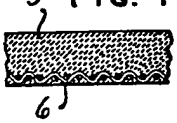

FIG. 2

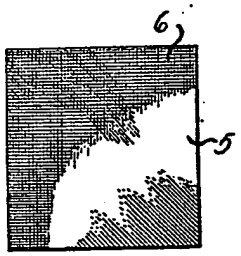

FIG. 3

FIG. 4

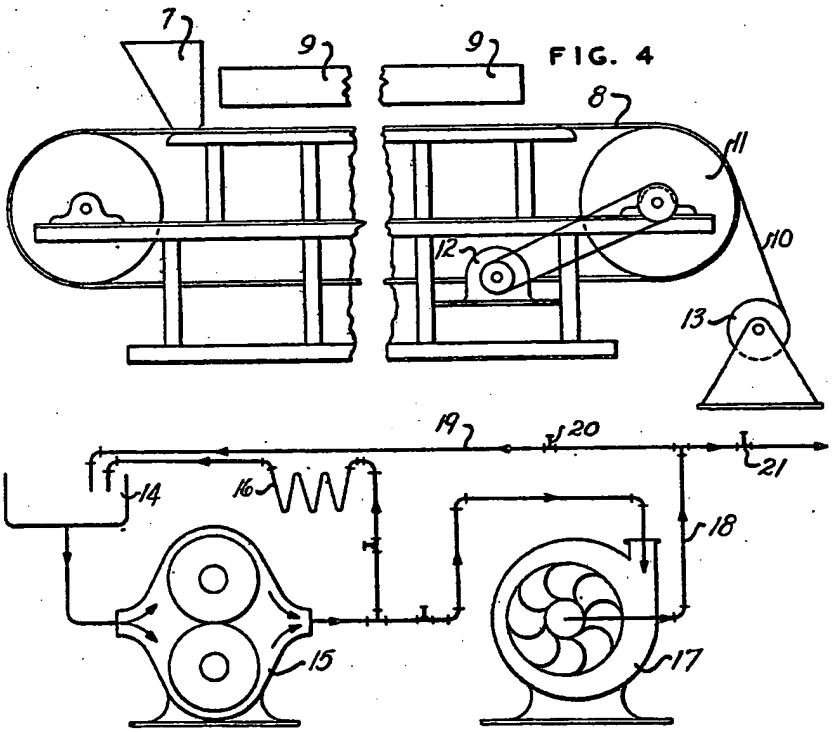

FIG. 5